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**Northern
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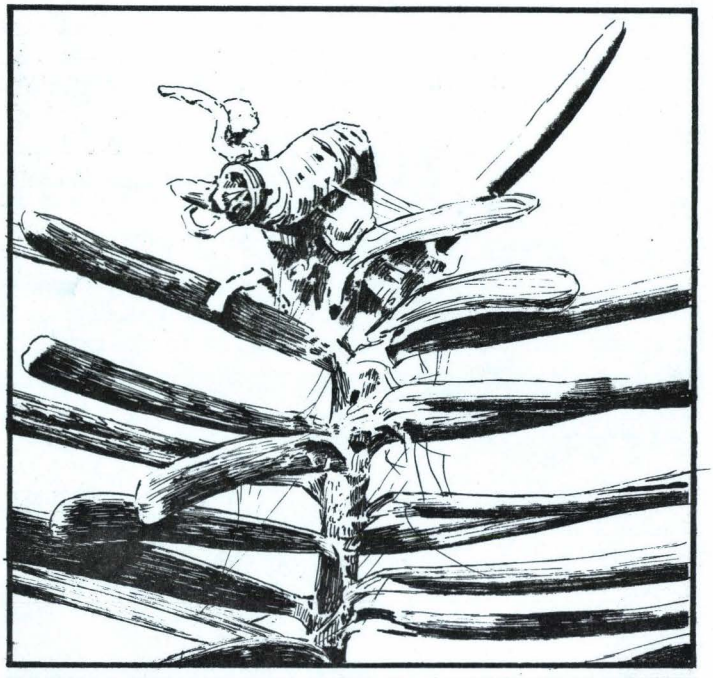
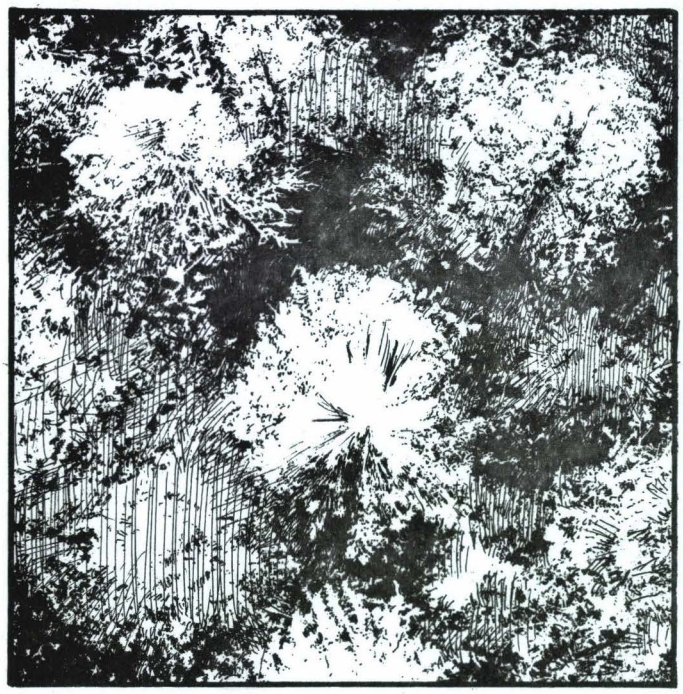
Department of
Natural Resources

Division of
Forestry

Forest Insect and Disease Conditions 1980 in Montana

Report No. 81-9





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ROCKY MOUNTAI[illegible]TION

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FOREST INSECT AND DISEASE CONDITIONS IN MONTANA
1980

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Report 81-9
June 1981

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INTRODUCTION

Beginning this year, a new format for reporting the status of forest insects and diseases in the Northern Region has been adopted. In the past there has been considerable overlap of the condition reports prepared by the USDA-Forest Service and the State forestry organizations of Montana and Idaho. To eliminate this unnecessary duplication, the present report covers forest insect and disease conditions on all ownerships (Federal, State, private) within Montana, and has been prepared jointly by the USDA-Forest Service and the Montana Division of Forestry. A similar report covering the State of Idaho has been prepared by the USDA-Forest Service and the Idaho Department of Lands.

This report will provide to forest land managers estimates of resource losses caused by the major pests and it will outline the extent and severity of current forest pest infestations. It will also provide an important historical record of forest insect and disease conditions in Montana.

Information reported here was gathered by personnel in the USDA-Forest Service, State and Private Forestry, and the Montana Division of Forestry.

SUMMARY OF CONDITIONS

Mountain pine beetle 1/ continued to be the most destructive forest pest on lands of all ownerships in Montana during 1980. Populations were epidemic on more than 2.3 million acres 2/ of lodgepole, ponderosa, whitebark, and western white pines. Tree mortality caused by other bark beetles was light. Although just under 1 million acres of visible defoliation to Douglas-fir/ true fir forests by western spruce budworm was observed by aerial surveyors in 1980, this was the lowest acreage defoliated in the last 10 years. Almost 1.3 million acres less were defoliated in 1980 than in 1979. Detectable larch casebearer defoliation was an estimated 25,000 acres. Better-than-normal cone production in many seed production areas partially offset the damage to cone crops by cone and seed insects. Greatest cone injury occurred to Douglas-fir and western larch in areas infested with western spruce budworm. Defoliation of mountain hemlock and other conifers by a budworm covered approximately 6,500 acres in northwestern Montana. Estimates indicate that more than 18 million cubic feet of lodgepole pine, Douglas-fir, and western larch growth are lost each year from dwarf mistletoes. Root diseases are widespread throughout Montana and are especially common west of the Continental Divide. An initial survey on the Lolo National Forest estimated that about 20,000 acres (1.2 percent) of the commercial forest lands were occupied by large centers of root disease. Larch needle cast was especially severe due to wet spring weather. Atropellis cankers were common on lodgepole pines in the western part of the State. Dutch elm disease continued at epidemic levels in Billings. Foliage diseases (needle casts, rusts) were common during 1980. Winter damage was not as extensive as in previous years.

1/ See appendix for list of scientific names
2/ Includes Yellowstone National Park

ENTOMOLOGY

Bark Beetles

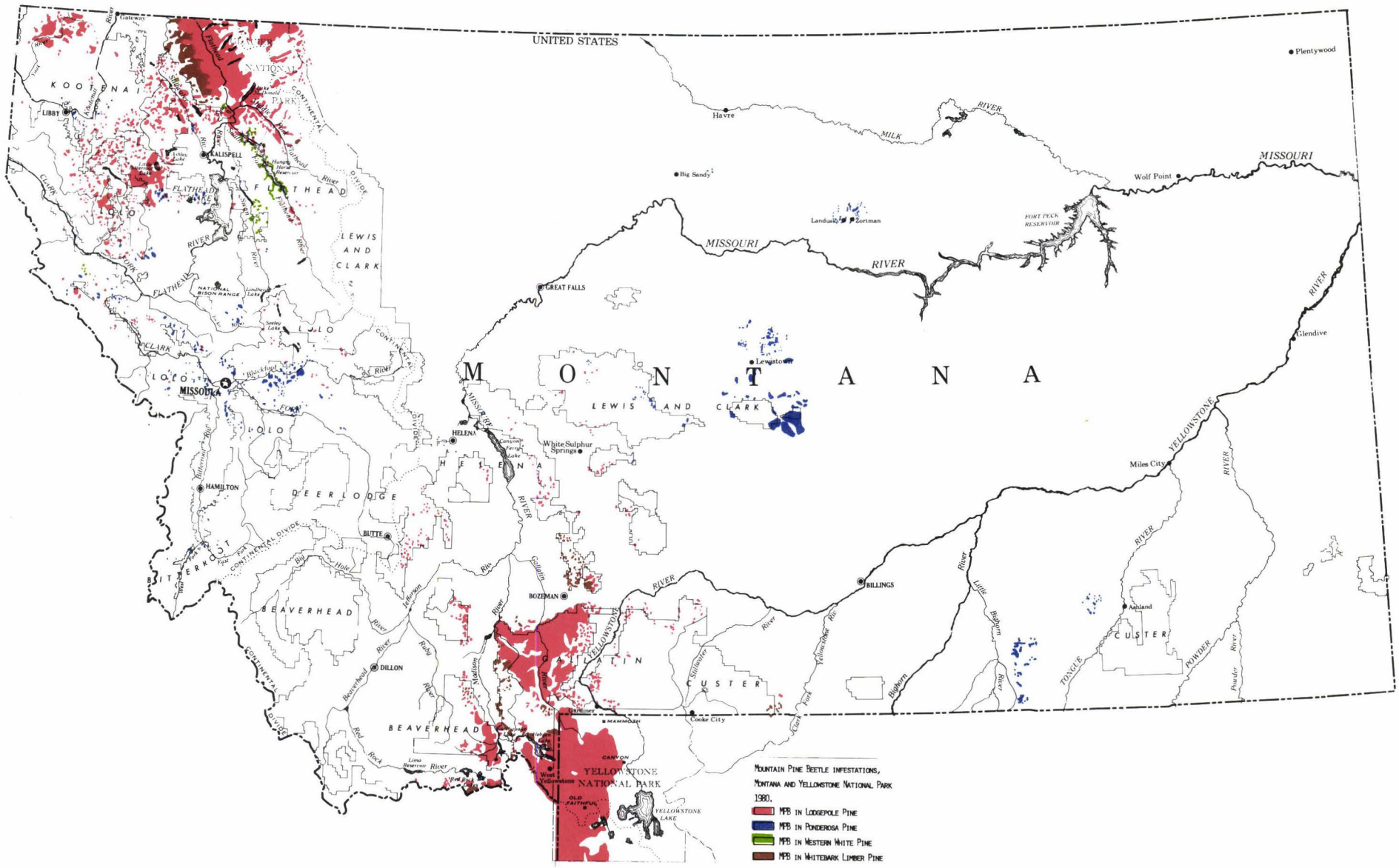
Mountain pine beetle continued to be the most destructive forest pest on lands of all ownerships in Montana in 1980. Though beetle populations are declining in some areas due to host depletion or management practices, epidemics still plague portions of the Beaverhead, Gallatin, Flathead, Lewis and Clark, Lolo, and Kootenai National Forest areas; Glacier and Yellowstone National Parks; the Blackfoot, Crow, and Fort Belknap Indian Reservations; and the Centennial Mountains. Infestations of lesser importance exist on the Bitterroot, Deerlodge, and Helena National Forest areas; the Flathead, Northern Cheyenne, and Rocky Boy Indian Reservations; and in the Garnet and Judith Mountains (mountain pine beetle map).

Lodgepole pine is the preferred host of the mountain pine beetle and most mortality occurs in that type. Significant amounts of other pine species are being killed, however. Epidemics occur in whitebark, limber, and ponderosa pine stands at several locations in the State. Smaller amounts of old-growth western white pine are killed each year, notably in the Flathead National Forest area, the Swan River State Forest, and in Glacier National Park. Aerial survey estimates of acres of faded trees (those killed in 1979) on all Federal lands within the State indicate 1,738,188 acres of lodgepole pine; 145,186 acres of whitebark/limber pine; 15,070 acres of ponderosa pine; and 2,155 acres of western white pine.

Mountain pine beetle infestations on State and private lands include 403,674 acres of lodgepole pine; 19,358 acres of whitebark/limber pine; 56,352 acres of ponderosa pine; and 2,350 acres of western white pine.

Acreage of all ownerships infested by mountain pine beetle increased from 1.6 million acres in 1979 to more than 2.3 million acres in 1980. Infestations are declining in some areas--principally due to elimination of susceptible trees--but overall, further increases are expected in 1981. Most lodgepole stands on National Forest lands and all lodgepole and ponderosa pine stands on State-owned lands have now been hazard-rated. Subsequent stand management is underway which will remove some of those high-risk, uninfested trees. Such management efforts are the only feasible means of reducing or preventing additional beetle-caused mortality.

Subalpine fir mortality attributable of the western balsam bark beetle declined statewide in 1980. Infestations were detected on the Beaverhead, Bitterroot, Flathead, Gallatin, and Lolo National Forest areas, but at levels considerably below those reported in 1979. These decreases likely resulted from natural fluctuations of the beetle's populations.


UNITED STATES
M O N T A N A
KOOTENAI
LIBBY
KALISPELL
FLATHEAD
LOLO
MISSOULA
LEWIS AND CLARK
HELENA
DEER LODGE
BUTTE
HAMILTON
BEAVERHEAD
DILLON
BOZEMAN
GREAT FALLS
Havre
Big Sandy
Landusky
Zortman
Wolf Point
Plentywood
Glendive
Lewistown
White Sulphur Springs
Miles City
BILLINGS
Ashland
CUSTER
FORT PECK RESERVOIR
MISSOURI RIVER
MILK RIVER
YELLOWSTONE RIVER
BIGHORN RIVER
TONGUE RIVER
POWDER RIVER
YELLOWSTONE NATIONAL PARK
Gardiner
MAMMOTH
Cooke City
West Yellowstone
OLD FAITHFUL
CANYON
YELLOWSTONE LAKE
MOUNTAIN PINE BEETLE INFESTATIONS, MONTANA AND YELLOWSTONE NATIONAL PARK 1980.
MPB IN LODGEPOLE PINE
MPB IN PONDEROSA PINE
MPB IN WESTERN WHITE PINE
MPB IN WHITEBARK LIMBER PINE

Douglas-fir beetle populations declined to near endemic levels throughout the range of Douglas-fir in the State. Some areas of standing attacked trees were noted on the Bitterroot, Deerlodge, Lewis and Clark, and Lolo National Forest areas. Those were most often associated with natural disturbances of adjacent stands and are not at this time considered major infestations.

Finally, pine engraver, fir engraver, and spruce beetle were detected at endemic levels only. While major problems with these beetles do not currently exist, a continuation of unusually dry weather through the spring months could bring about increased beetle activity in 1981.

Mountain Pine Beetle

Beaverhead National Forest area - Overall, infested acres of lodgepole pine decreased somewhat from 1979, while acres of faded whitebark pine increased markedly on the Madison Ranger District (tables 1 and 2). Decreases in infestation intensity were most notable in Jack Creek drainage, where susceptible host trees on both Federal and private lands have been largely depleted. On other parts of the District, principally from Elk Lake north to Wall Creek, acreage of faded lodgepole pine increased dramatically in 1980. Marked increase in areas of whitebark pine faders was observed east of the Madison River from about Deadman Creek north to No Man Peak. The epidemic also continued to increase on the northern portion of the Forest in the Tobacco Root Mountains in both pine types.

Ground plots established at selected locations on the District, which indicate population trends, showed an average of 27 new attacks per acre in 1980. Attacks in 1979 in those areas averaged 31 per acre. These figures do not represent Districtwide averages, but do give an indication of population dynamics for the areas surveyed. Based on these data and past history of the infestation, it is anticipated that the epidemic will remain at about its current level in 1981.

Table 3 shows amounts of lodgepole pine harvested on the Forest in 1980, and proposed cuts for 1981 as a result of beetle activity.

Bitterroot National Forest area - Substantial increases in ponderosa pine mortality were observed in 1980 on the Sula Ranger District. Most occurred in a few large groups in the Eightmile Creek drainage and several spots north of Shook Mountain. Other scattered mortality was noticed in small 5- to 10-tree groups, mostly east of the Bitterroot River.

Increases in mountain pine beetle activity on State and private lands were mainly near the Trapper Creek Job Corps Center and in the north end of the Sula State Forest.

On the West Fork Ranger District, some increases in ponderosa pine mortality were mapped along the Little Clearwater River between Lonely Mountain and Salamandar Butte. Lodgepole pine faders covered approximately the same acreage in 1980 as was observed in 1979 in the vicinity of Dennis Mountain. However, the scattered nature of the faded trees would indicate the infestation is spreading on that area 3/.

Table 1.--Acres of mountain pine beetle infestation on Federal lands in Montana, 1979 and 1980

Ownership	1979 LPP	1979 WBP	1979 PP	1979 WWP	1980 LPP	1980 WBP	1980 PP	1980 WWP	Trend
Beaverhead NF	88,190	3,231	------	-----	73,538	10,410	------	-----	Static
Bitterroot NF	649	------	1,076	-----	600	-------	735	-----	Static
Custer NF	1	------	77	-----	---------	600	------	-----	Increasing
Deerlodge NF	245	------	------	-----	1,495	-------	------	-----	Increasing
Flathead NF	97,237	23,708	386	1,669	122,637	93,525	30	1,020	Increasing
Gallatin NF	441,252	225	------	-----	323,010	14,824	------	-----	Static
Helena NF	1,065	895	428	-----	776	185	55	-----	Static
Kootenai NF	48,599	------	615	25	83,996	-------	320	10	Increasing
Lewis & Clark NF	30	361	15,010	-----	50	25	6,300	-----	Decreasing
Lolo NF	9,020	------	4,852	-----	13,840	-------	330	-----	Increasing
Glacier NP	206,115	8,912	------	855	276,266	14,997	------	1,125	Static
Yellowstone NP	431,114	------	------	-----	821,300	-------	------	-----	Increasing
Blackfeet IR	200	------	------	-----	11,584	-------	------	-----	Increasing
Crow IR	---------	------	1,940	-----	---------	-------	4,290	-----	Increasing
Flathead IR	---------	5	150	-----	80	-------	120	-----	Static
Fort Belknap IR	---------	------	592	-----	---------	-------	1,890	-----	Increasing
N. Cheyenne IR	---------	------	10	-----	---------	-------	300	-----	Increasing
Rocky Boy IR	---------	------	15	-----	10	-------	50	-----	Static
BLM	6,912	------	1,535	-----	9,040	10,620	650	-----	Increasing
Totals									
National Forests	686,288	28,420	22,444	1,694	619,942	119,569	7,770	2,155	Static
National Parks	637,229	8,912	------	855	1,097,532	14,997	------	-----	Increasing
Indian Reservations	200	5	2,707	-----	11,674	-------	6,650	-----	Increasing
BLM	6,912	------	1,535	-----	9,040	10,620	650	-----	Increasing
All Federal	1,330,629	37,337	26,686	2,549	1,738,188	145,186	15,070	2,155	Increasing

3/ This mortality actually occurred in the State of Idaho, but it is reported here since the Bitterroot National Forest is considered to be within the Montana reporting area.

Table 2.--Acres of mountain pine beetle infestation on State and private lands in Montana, 1979 and 1980

Reporting Area	1979 LPP	1979 WBP	1979 PP	1979 WWP	1980 LPP	1980 WBP	1980 PP	1980 WWP	Trend
Beaverhead NF	26,023	------	------	1,246	36,507	11,165	------	-----	Increasing
Bitterroot NF	----------	------	891	-----	----------	-------	1,235	-----	Static
Deerlodge NF	15	------	------	155	50	-------	------	-----	Static
Flathead NF	35,292	1,282	385	100	85,980	3,050	977	-----	Increasing
Gallatin NF	108,716	20	------	-----	221,089	5,143	------	-----	Increasing
Helena NF	180	25	333	-----	100	-------	------	-----	Decreasing
Kootenai NF	7,796	------	30	-----	22,523	-------	375	-----	Increasing
Lewis & Clark NF	----------	------	8,049	-----	60	-------	37,490	-----	Increasing
Lolo NF	2,885	------	3,659	-----	12,880	-------	879	-----	Increasing
Stillwater	643	489	------	250	10,035	-------	------	-----	Increasing
Swan River	----------	------	------	255	30	-------	180	2,350	Increasing
Thompson River	3,174	------	------	-----	14,421	-------	------	-----	Increasing
Garnets	----------	------	10,527	-----	----------	-------	12,222	-----	Increasing
Judith River	----------	------	8,611	-----	----------	-------	2,994	-----	Decreasing
Totals	184,724	1,816	32,485	2,006	403,674	19,358	56,352	2,350	Increasing

Table 3.--Management of mountain pine beetle infestation on Federal land in Montana, 1980

Ownership	Acres hazard-rated to date	Bf volume in millions logged in 1980--includes salvage and high-risk green	Bf volume in millions proposed for logging in 1981--includes salvage and high-risk green
Lodgepole Pine			
Beaverhead NF	593,615	8.1	13
Flathead NF	256,169	74 sold--14 cut	74.2
Gallatin NF	302,969	35.8	28
Kootenai NF	409,404	37.3 sold--4.9 cut	24.9
Lolo NF	655,584	10 sold--4 cut	18
Ponderosa Pine			
BIA	-------	----	----
BLM	-------	----	0.5

Custer National Forest area - Though the Sioux Division of the Forest was not aerially surveyed in 1980, scattered ponderosa pine mortality was observed near Stormy Butte in 1979. It can be assumed that some tree killing is continuing in that area.

On the Beartooth Division, approximately 1,000 whitebark pine faders were observed in 1980 near the Line Creek Guard Station south of Red Lodge. This infestation is static in nature and likely will continue in those high elevation stands until most of the larger diameter trees are killed.

Deerlodge National Forest area - Relatively recent beetle infestations continued to spread in susceptible lodgepole stands on the Forest in 1980. A few scattered faders were observed for the first time on the Deer Lodge Ranger District east of Moose Lake. The bulk of the epidemic, however, continued to build on the Butte Ranger District, where noticeable increases in faded lodgepole pines were mapped east of Butte, from Toll Mountain on the south to near Whitetail Reservoir on the north. Scattered groups of faders were observed in the Bull Mountains and around Elder Creek Campground.

Overall, the infestation spread from 245 acres in 1979 to nearly 1,500 acres in 1980. Continued increasing trend is anticipated through 1981.

Flathead National Forest area - The beetle infestation on Forest Service lands on the Flathead National Forest not only increased by nearly one-third in lodgepole pine type, but acres with significant whitebark pine morality quadrupled in 1980. Acres of infested lodgepole pine increased from 97,000 in 1979 to more than 122,000 in 1980 (table 1), and acres of infested whitebark pine type went from 23,000 to over 93,000 in the same period. Western white pine mortality declined by about 30 percent from 1979--extending over 1,000 acres. Few ponderosa pine faders were observed.

Acres of State and privately owned infested lodgepole pine increased from 35,000 in 1979 to almost 86,000 in 1980 (table 2). Acres of infested whitebark pine type increased from 1,200 to 3,000, and infestation in ponderosa pine went from 385 acres to almost 1,000 acres. The infestation on State and private lands in the McGregor Lake, Little Bitterroot Lake, and Ashley Lake areas, which were the most severe, continued to increase.

The Flathead infestation continued to be severe on the Glacier View Ranger District and State and private lands, including the Coal Creek State Forest west of the North Fork of the Flathead River. Tree killing there has begun to lessen, however, because of

accelerated harvesting of infested and green susceptible trees. On this District, the most marked increase was observed in whitebark mortality at higher elevations in the Whitefish Range. Increased activity was also noticed in lodgepole pine on State and private lands north of Columbia Falls.

The number of lodgepole faders observed increased greatly on the Hungry Horse Ranger District north of Hungry Horse. South and east of there, along the northern edge of Hungry Horse Reservoir, dramatic increases were again noticed in the number of faded lodgepole pines. Southward, on both sides of the reservoir, increased killing of western white pine by the beetle was observed. Near Spotted Bear, the approximately 200 lodgepole faders mapped in 1979 had increased to more than 500 in 1980.

Significantly more beetle-killed lodgepole were observed on the Tally Lake Ranger District in 1980 as well. Scattered groups of faders ranging in size from 5 to 800 trees were noted north and west of Tally Lake. Numerous smaller spots were mapped south of Ashley Lake. As dramatic as were the increases on National Forest land, an even greater number of dead trees was observed on State and private lands adjacent to Tally Lake Ranger District. Along the Stillwater River to the north and surrounding Little Bitterroot Lake on the south, the increase over 1979 was remarkable.

On the Stillwater State Forest, infestations on State and private lands in 1980 covered 10,035 acres (table 2). This was a substantial increase from 1979, when the infestation covered just under 1,400 acres. Increased activity was especially noticed in the area north of Whitefish and the main Stillwater drainage in the Stillwater State Forest, as well as on Fitzsimmons Creek and the East Fork of Swift Creek drainages.

On the Swan Lake Ranger District, increased killing of western white pine, lodgepole pine, and some ponderosa pine was noted in the Swan Valley. Much of that, however, was on State and private land around Swan Lake and southward along the Swan River.

Infestations detected on State and private lands in the Swan River State Forest in 1980 totaled 2,560 acres (table 2). These were mostly scattered white pines, but groups were killed in some cases. In 1979 only 255 acres were infested--one-tenth as much.

It is predicted that the beetle infestation on the Flathead National Forest will continue to decline on the Glacier View Ranger District, but increase on other Districts and adjacent State and private lands in 1981. Data were collected from over 200 variable-radius plots throughout the Glacier View Ranger District following beetle flight in 1980. The results of those data showed an average

12 trees per acre attacked in 1980, compared to 87 trees per acre in 1979. The data support our conclusion of a declining trend on that District. Elsewhere, data collected on the Hungry Horse Ranger District showed a nearly static trend--nine trees per acre attacked in 1980, 14 in 1979. Tally Lake plot averages showed over six trees per acre killed in 1980, compared to less than four in 1979. It must be kept in mind that these plot averages represent the areas surveyed only. Data cannot be extrapolated to a District-wide mortality estimate with statistical reliability. The data are valuable, however, along with other observations, in establishing trend predictions.

Gallatin National Forest area - Acres on which beetle-killed lodgepole pine were observed in 1980 decreased by more than 100,000 from 1979 (table 1). Much of that decrease was noted on the Bozeman-Gallatin Ranger District, principally in Gallatin Canyon, where infested acres decreased from 174,300 in 1979 to 124,700 in 1980. Still, virtually all the susceptible host type within the Gallatin River drainage is infested by the beetle to some degree. An additional indication is the increased number of whitebark pine faders observed at higher elevations. On this District, the infestation is still increasing through Hyalite Canyon, east of Bozeman through Bear Canyon and along Meadow Creek, and northward throughout the Bridger Mountains.

Infestations detected on State and private lands in the Gallatin National Forest area increased from 109,000 acres in 1979 to 226,000 acres in 1980 (table 2). Infestations intensified in many established areas, and the spread continued in lodgepole pine in the area between Bozeman and Livingston, and also near the mouth of Gallatin Canyon to the south and southwest of Bozeman.

On the Hebgen Lake Ranger District, the infestation is beginning to abate. Infested acres mapped in 1980 were essentially the same as 1979--a little over 103,000 acres each year. But the level of intensity of attack in many areas is lessening as availability of suitable host trees declines.

An increase in infested acres was observed along the west side of the Yellowstone River on both the Livingston and Gardiner Ranger Districts. Significant increases were noted in the upper portions of Tom Miner Creek, Rock Creek, and Big Creek drainages. Scattered, increased, and new infestation spots were mapped from Cliff Creek north to near Chimney Rock.

Ground surveys conducted on the Forest indicated 20 new attacked trees in 1980, down slightly from 21 in 1979 on the Bozeman-Gallatin Ranger District. Gardiner Ranger District plots showed an average increase from seven attacks per acre in 1979 to 10 in 1980.

Plot averages on the Hebgen Lake Ranger District supported our belief that beetle populations there are declining--10 attacked trees per acre in 1980, down from 32 in 1979. Livingston Ranger District plot averages also showed a decline, but plots established there were too few to adequately indicate a trend.

It is believed that the overall population trend of the beetle on the Forest is static. It is increasing in some areas, but decreasing in others. Infestations on the Hebgen Lake Ranger District and the Gallatin Canyon portion of the Bozeman-Gallatin Ranger District will likely decrease in intensity in 1981. Epidemics on the remainder of the Forest should continue to spread. Infestations on State and private lands from near the mouth of Gallatin Canyon, southwest of Bozeman, east toward Livingston will continue to increase.

Helena National Forest area - Compared with other Forests in the State, mountain pine beetle problems on the Helena National Forest area are minor. Some scattered tree killing occurred in lodgepole and white bark pine stands in the Big Belt Mountains east of Canyon Ferry Lake. Several groups of lodgepole faders ranging from 3 to 100 trees in size were mapped along the North Fork of Deep Creek and Sulphur Bar Creek on the Townsend Ranger District. Others were observed on the eastern edge of the Elkhorn Mountains. A few scattered groups of from 5 to 10 ponderosa pine faders were noted on the Helena-Canyon Ferry Ranger District south of Helena. The infestation likely will remain static on the Forest.

Kootenai National Forest area - The beetle infestation on the Kootenai National Forest continued to devastate susceptible lodgepole stands--increasing on Forest Service ownership from 48,600 acres in 1979 to 84,000 acres in 1980. Infestations on State and private lands in the Kootenai National Forest area in 1980 totaled almost 23,000 acres, compared to approximately 8,000 acres in 1979. The most significant increases occurred on the Fisher River and Yaak Ranger Districts, but scattered infestations could be found in lodgepole pine types of virtually every District. Areas totaling approximately 300 acres of widely scattered ponderosa pine mortality were observed on Forset Service lands and 375 acres on State and private lands. A small amount of western white pine was killed on the Yaak Ranger District.

A marked increase of infested acres was mapped on the Yaak Ranger District along the Yaak River from Whitetail Creek to the river's head near Dodge Summit. On this District alone, the epidemic spread from 33,000 acres in 1979 to over 64,600 acres in 1980. Despite accelerated harvesting, the infestation is expected to continue its spread into 1981. Average plot data from more than 200 ground plots on the District showed 14 new attacks per acre in 1980, an increase from the 11 trees per acre killed in 1979.

The next most dramatic increase occurred on the Fisher River RD and surrounding State and private land, especially the area from Fisher River on the west to Little Bitterroot Lake on the east, and from Lower Thompson Lake north to near Sugarloaf Mountain. In this area the infestation increased from small scattered groups of 15 to 100 trees to many large groups of faders containing 500 to 1,000 trees. South and west of McGregor Lake, the estimate of dead trees rose from about 8,500 in 1979 to more than 80,000 in 1980. Ground plot data from near McGregor Lake suggested the infestation may have already peaked there. Throughout the remainder of the District, however, the epidemic is expected to increase.

Other portions of the infestation increased on the Rexford Ranger District. A marked increase was observed in the Gold Creek drainage, and other new groups of faders were mapped along the west side of Lake Koocanusa.

Smaller but significant infestations are building on the Fortine Ranger District. Along Fortine Creek, Sunday Creek, and Louis Creek, substantial increases were noted this year.

The infestation will continue to increase in 1981 in spite of renewed efforts to remove susceptible trees (table 3). Depressed timber markets and enormous beetle populations make it difficult for the land manager to slow the beetle's advance.

Lewis and Clark National Forest area - Scattered ponderosa pine mortality attributable to the beetle on the Forest area declined in 1980. Infestations on the Judith Ranger District along the Judith River and south of Lewistown decreased to widely separated small groups. Some new groups of from 10 to 20 trees were recorded on BLM land both north and south of Lewistown. Ground plot data in some of those stands suggested a building population.

The infestation southeast of Lewistown (Little Snowy Mountains and Flatwillow Creek) on State, private, and BLM lands increased in size from 8,000 acres in 1979 to 37,000 acres in 1980, but the infestation intensity remained much the same with mostly scattered trees killed over much of the area.

In the Judith and Moccasin Mountain areas, the overall infestations declined from 8,600 acres in 1979 to 3,000 acres in 1980, though some areas of infestation are still increasing in the Judith Mountains.

Some small groups of ponderosa faders were noted west of Belt Creek on the Belt Creek Ranger District. This was an increase over that mapped in 1979.

On White Sulphur Springs Ranger District, scattered beetle-caused mortality in lodgepole pine remained static in the area surrounding Elk Peak. The nature of the lodgepole stands in that area suggests that scattered mortality in the bigger, older trees will continue. The stands probably will not support a major epidemic, however.

Lolo National Forest area - Forestwide, the mountain pine beetle was not a major pest in 1980, though the serious epidemic on the Plains Ranger District continued to deplete susceptible lodgepole stands throughout the Thompson River drainage. Of the 13,800 acres of National Forest land with infested lodgepole type on the Forest, 12,600 were on the Plains Ranger District. Scattered mortality in lodgepole and ponderosa pine was found on several Districts.

Much of the infested lodgepole throughout the Thompson River drainage is of mixed ownership. On that portion administered by the Plains Ranger District, the infestation increased from 5,500 acres in 1979 to over 12,600 acres in 1980. Increases in the infestation were noted throughout the region from Murr Creek south to the Clark Fork River. Especially notable increases occurred near Fishtrap Creek, Fishtrap Lake, and Bend Campground. Ground data collected from more than 100 plots on the District indicated a still-rising population, with 27 newly attacked trees per acre in 1980. It is anticipated that the infestation will continue its spread until susceptible host trees are killed or removed.

Infestations in lodgepole pine on State and private lands in the Thompson River area in 1980 totaled over 14,000 acres, a substantial increase from the 3,000 acres infested in 1979. Though much logging has been done to salvage mountain pine beetle-killed and green susceptible trees on industry and other private lands in the Thompson River area, the insect continued to expand infestation boundaries and caused substantial losses in 1980.

Some widely scattered mortality was observed in ponderosa and lodgepole pine types on both the Missoula and Ninemile Ranger Districts, but these infestations do not appear to be spreading at this time. Dispersed groups of faders mapped in 1980 on the Seeley Lake Ranger District were both fewer and smaller than those recorded in 1979.

Garnet Mountains - Mountain pine beetle infestations recorded in ponderosa pine on State and private lands in the Garnet area in 1980 totaled just over 12,000 acres, compared to 10,500 acres in 1979. Infestations continued to spread somewhat in 1980, but trees killed per acre and volumes lost were down, indicating infestations are declining in several areas due to lack of host material where outbreaks have been present for the past several years. Activity

continued in the Clark Fork drainage east of Missoula and in the Blackfoot River drainage, especially near Diamond Mountain, Morrison Peak, Camas Creek, Ninemile Prairie, Sunset Hill, and Jones Meadow.

Glacier National Park - Acres of infested lodgepole pine, and to a much lesser extent whitebark pine, increased somewhat in 1980. However, much of this increase occurred on the east side of the Park where beetle populations are still building. On the west side, principally the North Fork of the Flathead River drainage, tree killing has peaked due to host depletion (figure 1). Over 276,000 acres of faded lodgepole were recorded this year, compared to 206,000 in 1979.

On the western side of the Park, from McDonald Lake north to the Canadian border, virtually all susceptible lodgepole pine have been killed. As the beetles continue to attack increasingly smaller trees and even the normally nonhost Engelmann spruce, fewer brood will be produced to sustain the infestation. From McDonald Lake to the southeast along the Middle Fork of the Flathead River, infestations are still building and infested acres increased markedly over 1979. However, huge expanses of lodgepole pine are not as prevalent in that part of the Park.

The infestation on the east side of the Park is building rapidly from the Canadian border southward. Tremendous increases were observed in the Belly River drainage, and around Swiftcurrent, Sherbourne, and Saint Mary Lakes.

Figure 1.--Mountain pine beetle caused mortality of lodgepole pine. Recent faders in the foreground and older mortality in the background.

One area from which ground data were collected showed a seven-fold increase in new attacks from 1979 to 1980. Tree killing also increased around Waterton Lake and westward along the Canadian-U.S. border. Infestations in the Park east of the Continental Divide will continue to spread throughout susceptible stands in the Park and adjacent lands in 1981.

Yellowstone National Park - A remarkable increase in infested areas of lodgepole pine occurred in 1980. Nearly twice as many acres containing infested trees were observed--431,000 in 1979; 821,300 in 1980 (table 1). Many areas in the Park have had new tree killng and much has been reinfested, as trees bypassed by the beetle earlier in the infestation are now being killed. Virtually all the lodgepole pine type in the western half of the Park is affected to some degree. Data collected from ground plots established in eight different parts of the infestation exhibited a wide range of beetle activity. At Elk Park and on the Fire Hole River drainage, a 16:1 increase in newly attacked trees was observed. Other plot data showed a decrease. Overall, the Yellowstone infestation is expected to increase locally in intensity without much increase in infested acres.

Blackfeet Indian Reservation - Infested lodgepole pine on the Blackfeet Indian Reservation increased from an estimated 200 acres in 1979 to more than 11,500 acres in 1980. These stands, which are adjacent to the eastern edge of Glacier National Park, show the same drastic buildups of beetle populations described for the Park. Infestations are especially heavy from Otatso Creek northward to the Reservation boundary. Depressed markets for lodgepole pine are hampering stand management on the Reservation. Unless susceptible stands are removed, the infestation will continue its increase for the next several years.

Crow Indian Reservation - Ponderosa pine mortality on the Reservation increased in 1980 to nearly 4,300 acres--a two-fold increase over the almost 2,000 acres recorded in 1979. Most of the infestation was located along Corral Creek and Little Corral Creek. Other groups of faders were observed along Cache Creek, North Fork Indian Creek, and tributaries of Youngs Creek. Salvage and preventive logging continued on the Reservation, but additional tree killing will likely occur in overstocked stands.

Flathead Indian Reservation - Ponderosa pine faders observed on the Reservation in 1980 remained at the relatively low level mapped in 1979. A few scattered groups of 5 to 10 trees on approximately 120 acres were noted near the North Fork of the Jocko River, O'Keefe Creek, and Hot Springs Creek. Other smaller groups were observed

in various parts of the Reservation. Small groups of lodgepole faders on about 80 acres were mixed with ponderosa pine on the North Fork of the Jocko River and Hot Springs Creek drainages. No notable increases in the infestation on the Reservation are expected in 1981.

Fort Belknap Indian Reservation - A beetle infestation is currently expanding in ponderosa pine stands in Lodgepole Creek and Beaver Creek drainages, and Bear Gulch, having increased from 600 acres in 1979 to almost 1,900 acres this past year. Other scattered infestations were noted in the Little Peoples Creek drainage and along Rock Creek. Where stands are overstocked, overmature, and decadent, beetle populations can be expected to increase.

Northern Cheyenne Indian Reservation - Widely scattered small groups of ponderosa pine faders were mapped east of Lame Deer in 1980. These infestations were mostly confined to areas near Lame Deer Creek and its tributaries, Alderson Creek, Stebbins Creek, and Crazy Head Fork of Logging Creek drainages. Stands on the Reservation area currently being risk-rated and subsequent management should help alleviate beetle buildups. Without adequate stand management, infested acreages will increase.

Rocky Boy Indian Reservation - A few small groups of ponderosa pine faders were observed on the Reservation along Sandy Creek and Muddy Creek. The infestation currently is small, probably not exceeding 60 acres total. One small group of lodgepole faders was noticed north of Baldy Mountain. Neither infestation is expected to increase significantly in the next year.

Bureau of Land Management - The most serious beetle infestation on BLM lands in the State was in lodgepole and whitebark pine types in the Centennial Mountains just south of the Centennial Valley. Over 9,000 acres of lodgepole faders and 10,000 acres of whitebark faders were mapped there in 1980. This total of nearly 20,000 acres was up from only about 8,000 acres observed there in 1979. The Montana portions of these stands are not extensive and most of those were already infested. Beetle populations should peak there within the next few years.

Scattered ponderosa pine mortality occurred on BLM land in the Judith Mountains north of Lewistown. Most groups were comprised of fewer than 100 trees. Some increases could be expected in susceptible trees in that area.

Finally, a scattering of both lodgepole and ponderosa pine faders was observed on BLM land in the Garnet Mountains east of Missoula. Ground data from that area indicate the infestation is building and that increased tree killing can be expected.

Douglas-fir Beetle

Bark beetles other than the mountain pine beetle were of small consequence throughout the State in 1980. Small group killings of Douglas-fir, which are nearly always associated with root disease or a stand disturbance, were observed on the Bitterroot, Deerlodge, Flathead, Helena, Kootenai, Lewis & Clark, and Lolo National Forest areas, and on the Swan River State Forest. One small group of 15 trees was noted on the Rocky Boy Indian Reservation (tables 4 and 5).

Mortality attributable to the Douglas-fir beetle can be lessened by prompt salvage of disturbed stands where stand conditions are conducive to beetle buildup. None of the beetle spots noted in 1980 are considered to be epidemic. Barring significant changes in stand conditions, beetle populations and associated tree mortality are not expected to increase in 1981.

Western Balsam Bark Beetle

Numbers of subalpine fir killed by the western balsam bark beetle continued to be locally severe on a few forest areas. Approximately 645 acres of fader trees were observed on Forest Service lands in the Madison Ranger District, Beaverhead National Forest, scattered in several areas of the Gravelly Range. A total of 640 acres of faders were detected on State and private lands in the Beaverhead National Forest area. On the Flathead National Forest, about 800 acres of faders were noted, primarily in Granite Creek drainage of the Hungry Horse Ranger District. A little more than 200 acres of scattered subalpine fir mortality were observed on the Gallatin National Forest--most of which occurred in the Tom Miner Creek drainage, Gardiner Ranger District. Approximately 50 acres of mortality to subalpine fir occurred on State and private lands in the Gallatin National Forest area. An additional 400 acres were infested on BLM lands in the Centennial Mountains. No other significant infestations were noted throughout the State, though minor groups were observed on the Bitterroot and Lolo National Forests (tables 4 and 5).

Little is known about the biology of the western balsam bark beetle. Neither do we fully understand the interactions of the beetle, associated pests, and stand conditions which contribute to subalpine fir mortality attributable to the beetle. Therefore, it is difficult to accurately predict trends where infestations occur. It is believed that where subalpine fir stands are overstocked, overmature, root-diseased, or physiologically stressed, beetle-caused mortality will continue.

Table 4.--Acres of bark beetle infestations (other than mountain pine beetle) on Federal lands in Montana, 1980

Ownership	Douglas-fir Beetle	Western balsam bark beetle	Pine engraver	Fir engraver	Spruce beetle
Beaverhead NF	---	645	---	---	---
Bitterroot NF	50	20	50	5	---
Custer NF	---	-----	---	---	---
Deerlodge NF	80	-----	---	---	---
Flathead NF	10	800	---	---	---
Gallatin NF	---	210	---	---	---
Helena NF	35	-----	---	---	---
Kootenai NF	10	-----	---	2	---
Lewis & Clark NF	80	-----	---	---	---
Lolo NF	50	10	80	---	5
Glacier NP	---	-----	---	---	---
Yellowstone NP	---	-----	---	---	---
Blackfeet IR	---	-----	---	---	---
Crow IR	---	-----	---	---	---
Flathead IR	---	-----	10	---	---
Fort Belknap IR	---	-----	---	---	---
Northern Cheyenne IR	---	-----	---	---	---
Rocky Boy IR	10	-----	---	---	---
BLM	10	400	---	---	---
Total					
National Forests	315	1,685	130	7	5
National Parks	---	-----	---	---	---
Indian Reservations	10	-----	10	---	---
BLM	---	400	---	---	---
All Federal	325	2,085	140	7	5

Table 5.--Acres of bark beetle infestations (other than mountain pine beetle) on State and private lands in Montana, 1980

Reporting area	Douglas-fir Beetle	Western balsam bark beetle	Pine engraver
Beaverhead	---	640	---
Bitterroot	---	---	95
Custer	---	---	---
Deerlodge	10	---	---
Flathead	---	---	---
Gallatin	---	50	---
Helena	---	---	---
Kootenai	---	---	---
Lewis & Clark	80	---	---
Lolo	30	---	---
Stillwater	---	---	---
Swan River	60	---	---
Thompson River	---	---	150
Garnets	---	---	---
Judith River	---	---	---
Total	180	690	245

Other Bark Beetles

Few other bark beetle infestations were observed in 1980. Small outbreaks of pine engraver were noted on the Lolo National Forest, principally on the Plains and Ninemile Ranger Districts, and on State and private lands in the Thompson River area. Other scattered tree killing occurred on the Bitterroot National Forest area, often in association with other bark beetles (tables 4 and 5). Pine engraver outbreaks are usually associated with improper slash disposal, stressed stand conditions, and drought. Amelioration of these factors will lessen the beetle's impact. Conversely, a worsening of any or all of these factors can trigger locally severe epidemics.

Two additional bark beetle infestations were mapped, but in endemic proportions only. A small clump of Engelmann spruce faders, attributable to the spruce beetle, was noted on the Ninemile Ranger District, Lolo NF (table 4). One- and two-tree groups of grand fir killed by fir engraver were mapped on the Bitterroot and Kootenai National Forests. Unless serious stand disturbances occur, increased mortality from these beetles is not expected in 1981.

Defoliators and Cone and Shoot Insects

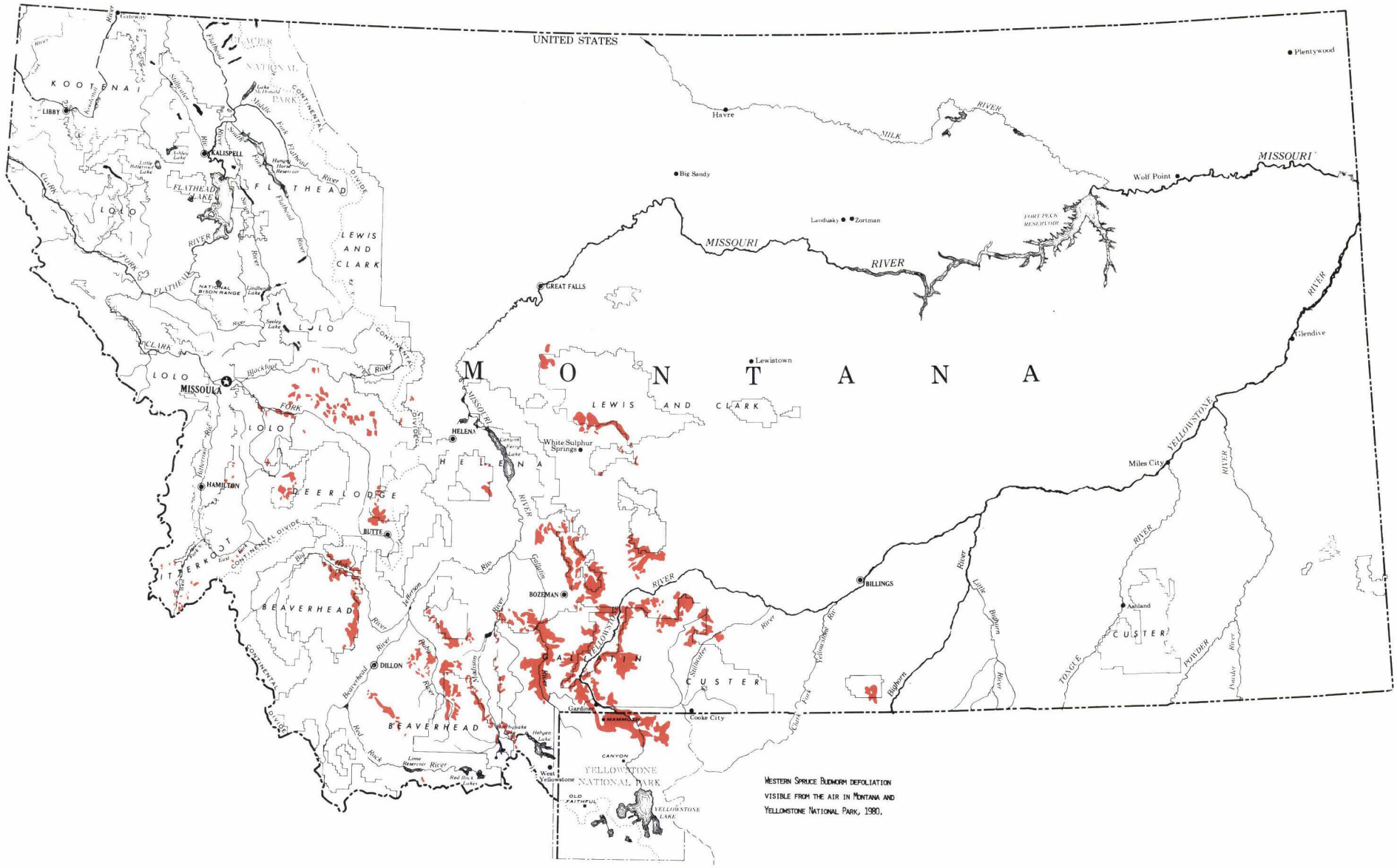
Western Spruce Budworm

The western spruce budworm outbreak contined throughout many of the Douglas-fir and true fir stands in Montana and Yellowstone National Park in 1980 (western spruce budworm map). Visible defoliation was detected on a total of 974,302 acres of all ownerships (table 6).

Table 6.--Acres of aerially visible western spruce budworm defoliation on all ownerships in Montana and Yellowstone National Park in 1979 and 1980

Reporting area	1979	1980	Change
Beaverhead NF	349,889	179,215	- 170,674
Bitterroot NF	84,487	3,860	- 80,627
Custer NF	5,373	30,910	+ 25,537
Deerlodge NF	402,638	27,004	- 375,634
Flathead NF	1,803	0	- 1,803
Flathead IR	3,523	0	- 3,523
Gallatin NF	325,921	510,119	+ 184,198
Helena NF	463,175	3,630	- 459,545
Kootenai NF	1,438	0	- 1,438
Lewis & Clark	211,493	57,112	- 154,381
Lolo NF	84,827	7,290	- 78,537
Garnet Mountains 1/	249,485	29,202	- 220,283
Subtotal	2,185,052	848,342	- 1,336,710
Yellowstone NP	75,525	125,960	+ 50,435
Grand Total	2,260,577	974,302	- 1,286,275

1/ Previously included in the Lolo NF total.



WESTERN SPRUCE BUDWORM DEFOLIATION VISIBLE FROM THE AIR IN MONTANA AND YELLOWSTONE NATIONAL PARK, 1980.

Acres of visible defoliation reported for 1980 were the lowest in 10 years (table 7). This also represents the largest net change in as many years. However, the figures for 1980 in tables 6 and 7 may not represent an actual decline in the infested area. Cool, wet weather in May 1980 (over four times the normal precipitation) plus good shoot growth caused many areas to go undetected even though budworm populations in these areas remained active. Ground surveys on portions of the Deerlodge National Forest near Butte found extensive areas of moderate to heavy budworm populations that were not reported from the air. Egg mass surveys on the Gallatin and Beaverhead National Forests also showed many differences between extent and intensity reported from the air versus ground data. One major exception to the overall decline was an area of new infestation on private and Forest Service land in the Boulder River drainage between Livingston and Big Timber.

Table 7.--Area of visible defoliation on all ownerships caused by western spruce budworm in Montana and Yellowstone National Park during past 11 years

Year	Acres of visible defoliation	Change from previous year
1970	1,807,800	- 729,240
1971	2,532,800	+ 725,000
1972	2,696,760	+ 163,960
1973	1,538,380	- 1,115,380
1974	2,020,873	+ 482,493
1975	2,797,448	+ 776,575
1976	2,558,623	- 238,835
1977	2,979,173	+ 420,550
1978	2,465,520	- 413,653
1979	2,260,577	- 204,942
1980	974,302	- 1,286,275

Several accelerated research and development activities coordinated through the Canada-United States Spruce Budworms Program (CANUSA) were conducted in Montana during 1980. Encouraging results of a demonstration of Douglas-fir foliage and cone protection using an early ground application of acephate and carbaryl prompted treatment with these materials again in 1980 using double and triple applications. Seed production per cone was greatly improved with the double treatment, but the third application increased seed production only another three

seeds per cone. Treated cones produced between 33 and 44 seeds per cone while the control cones produced only 22 seeds per cone. X-ray data will be used to determine the number of sound seeds in each group. Defoliation on the treated trees fell between 1 and 5 percent, and for the untreated control trees, defoliation was 77 percent.

In other protection work, Orthene Acecaps® implants were used on Douglas-fir trees against the western spruce budworm. Cone samples were collected at 30-, 60-, and 90-day intervals following treatment for residue analysis. Treatment differences did not appear to be significant.

Followup evaluations were made for two field experiments conducted by research scientists from the Pacific Northwest Forest and Range Experiment Station (PNW). A posttreatment-year larval population survey was made in Red Cliff Campground and Swan Creek and Squaw Creek drainages to determine treatment carryover from a Bacillus thuringiensis (Bt) and baculovirus field experiment conducted in 1979 on the Gallatin National Forest. The PNW Station is also studying the relationship between the number of captured adult budworm in pheromone-baited traps and subsequent feeding damage. Each trap site was revisited in 1980 to record defoliation by crown thirds and shoot counts.

Larval samples collected near White Sulphur Springs and analyzed by PNW confirmed the incidence of a baculovirus disease among the budworm population in Miller Gulch. The naturally occurring infection provides a unique opportunity to study the epizoology of this virus in a natural budworm population. In cooperation with PNW, Northern Region has established permanent plots to follow year-to-year epizootic changes.

Budworm-related activities scheduled for 1981 include a pilot project to evaluate the operational effectiveness of two Bt formulations: a study by PNW to determine the effect of ants and birds on budworm population dynamics, and a simulated aerial application field experiment by the Insecticide Evaluation Project, Pacific Southwest Forest and Range Experiment Station (PSW), to screen insecticides for larger field testing.

Larch Casebearer

In 1980, aerially detectable larch casebearer defoliation declined substantially on the Kootenai and Flathead National Forest areas from 1979 levels. However, an increase in defoliation occurred in the southern portions of the larch range in Montana. Aerially visible defoliation was noted for the first time in three areas in the vicinity of Missoula: the upper Blackfoot River drainage, the Clark Fork drainage east to to Drummond, and the Bitterroot River drainage south to Stevensville. An estimated 25,000 acres of aerially visible defoliation were observed on western larch in the State in 1980.

Cone and Seed Insects

Better-than-normal cone production occurred in 1980 on many of the 26 seed production areas throughout the State that were surveyed for cone and seed insect injury. Sample cones were regularly collected from Douglas-fir, western larch, Engelmann spruce, lodgepole pine, and ponderosa pine. Half of the cones were dissected

and the remainder were placed in insect rearing containers. Greatest cone injury (50 to 100 percent) occurred to Douglas-fir and western larch in areas infested with western spruce budworm. Coneworms were very damaging to ponderosa pine cones in some areas.

A New Budworm

The first documented report of this insect being a forest pest was in 1978, when it defoliated about 40 acres of mountain hemlock and other conifers north of Wallace, Idaho (figure 2). The infestation spread onto the Kootenai National Forest in Montana, and in 1980 defoliation was conspicuous on more than 11,000 acres in the two States (approximately 6,500 acres in Montana). Permanent injury--top killing and tree mortality--has occurred to the understory in the areas of most severe defoliation. Extensive larval mortality caused by natural enemies took place in 1980, indicating the possibility of a population decline in 1981. Large numbers of larvae were sent to the Insecticide Evaluation Project, PSW Station, for insecticidal screening. This could lead to the eventual registration of a chemical control alternative.

A Needle Miner in Ponderosa Pine

The only report of defoliation caused by this insect in 1980 was light damage on the campus of the University of Montana in Missoula.

Figure 2.--Larva of a new budworm defoliating mountain hemlock

PATHOLOGY

Dwarf Mistletoes

Dwarf mistletoe have caused serious forest diseases in Montana. The greatest impact of these obligate parasites has been reduction of growth potential, although some tree mortality has occurred.

Many acres of commercial forest in Montana are currently infected with dwarf mistletoes. Estimates of volume loss due to major dwarf mistletoes on National Forests in Montana are summarized in table 8. More than 18 million cubic feet of lodgepole pine, Douglas-fir, and western larch are lost annually due to these serious pests. Fortunately, losses can be reduced by proper silvicultural treatments. Dwarf mistletoe control should be incorporated into management of infested stands.

Most dwarf mistletoe management is accomplished during routine stand treatments. Special dwarf mistletoe presuppression surveys were conducted on 2,393 acres within the Bitterroot and Lolo National Forests in 1980. These surveys provided a basis for future control projects. During the year, special dwarf mistletoe control was conducted on 375 acres within the Bitterroot National Forest.

Root Diseases

Root diseases, widespread in many forested areas of Montana, have been especially serious west of the Continental Divide. Tree mortality is probably the major impact of root diseases. Bark beetles and wood borers often attack diseased trees, hastening mortality. Root diseases are probably associated with much of the scattered, annual conifer mortality attributed to insects and other causes.

Although quantitative effects on growth and stand productivity are unknown, such losses are probably substantial.

Root disease impact surveys on large areas are needed to quantify losses and to help establish management objectives and priorities. An initial survey on the Lolo National Forest estimated that a total of almost 20,000 acres, or about 1.2 percent of the commercial forest land in the Forest, was occupied by large root disease centers detectable from the air. This very conservative estimate excluded extensive small group or individual tree mortality caused by root disease. Additional impact surveys are planned for several other National Forests in Montana. In time, the surveys will address tree mortality and volume loss, in addition to infected area.

Table 8.--Growth loss of lodgepole pine, Douglas-fir, and western larch caused by dwarf mistletoes in Montana National Forests

National Forest	Tree species 1/	Percentage of stands infected 2/	Volume loss 3/ cu. ft./acre/yr.	Volume loss 3/ M cu. ft./yr.
Beaverhead	LP	52.4	6.1	1,291
Bitterroot	LP	44.3	7.9	467
	DF	43.2	20.0	3,258
	WL	40.0	20.0	32
Custer	LP	28.2	8.8	106
Deerlodge	LP	46.6	11.1	2,499
Flathead	LP	18.4	15.3	641
	DF	0.7	20.0	30
	WL	33.7	20.0	936
Gallatin	LP	42.0	7.6	500
Helena	LP	35.4	9.2	814
Kootenai	LP	22.5	18.5	2,250
	DF	1.4	20.0	126
	WL	15.3	20.0	902
Lewis & Clark	LP	36.6	10.0	1,541
Lolo	LP	22.6	6.9	701
	DF	17.4	20.0	2,122
	WL	30.0	20.0	240
Subtotals (All Forests)	LP	----	----	10,810
	DF	----	----	5,536
	WL	----	----	2,110
Total	All	----	----	18,456

1/ Tree species: LP = lodgepole pine; DF = Douglas-fir; WL = western larch.

2/ Estimates from impact surveys done in 1978, 1979, and 1980.

3/ Estimates of lodgepole pine growth loss in cubic feet/acre/year were made using RMYLD. Douglas-fir and western larch estimates were made from previous studies conducted in the Region.

Numerous fungi are associated with root diseases in Montana. One causing laminated root rot is common on Douglas-fir and grand fir in the northwetern portion of the State. This fungus frequently causes large mortality centers and restricts production on infected sites for many years.

Another widespread root pathogen is the Armillaria root rot fungus. This fungus may occur alone or in conjunction with other fungi to form root disease complexes. Such a complex was discovered in Douglas-fir at several locations on the Lolo National Forest area and Flathead Indian Reservation. Individual trees were found to be infected with both Armillaria root rot and black stain root disease. Black stain was located on small roots, often on trees without above-ground disease symptoms. Armillaria was typically present at the root crown. Diagnosis of black stain was difficult because the stain usually could not be detected at the root collar in the presence of Armillaria. It appears that black stain may predispose trees to infection by Armillaria root rot. Black stain root disease was also found on lodgepole pine on the Helena National Forest; infected trees also had Atropellis cankers.

Another major root pathogen in Montana is the "velvet top" fungus which causes brown cubical butt rot of conifers. This pathogen is often associated with Armillaria root rot on Douglas-fir. Extensive Douglas-fir blowdown on the Ninemile Ranger District (Lolo National Forest) was associated with butt rot and Armillaria infection.

Annosus root rot causes localized ponderosa pine mortality in previously cutover areas. Pockets of mortality occur adjacent to stumps; several disease centers have been located near Missoula.

Larch Needle Casts

Larch needle casts were especially severe in 1980 due to very wet spring weather. Trees of all ages were affected; the disease was reported in mature stands as well as in young regeneration. Larch needle blight was characterized by infected needles that turned brown early in June, followed by spur shoot necrosis. Meria needle cast attacked needles throughout the growing season, with infected needles shed shortly after death.

Atropellis Canker

Atropellis cankers were common on lodgepole pine in western Montana. Infections resulted in bole deformations, and tree mortality occurred when stems were girdled by perennial cankers. No treatment was considered unless extensive infection occurred in high use areas such as recreation sites.

Dutch Elm Disease

This disease continued at epidemic proportions in Billings. However, an aggressive sanitation program by the city resulted in a reduced number of trees killed during 1980. Only 220 elms were killed by Dutch elm disease in 1980, whereas 987 were killed by the disease in 1979. The dead trees were removed by city crews.

Other Diseases

Foliage diseases were common during 1980 in Montana. Several needle casts were reported, including grand fir needle cast and lodgepole pine needle cast. Fir willow weed rust and fir blueberry rust were also common on true firs in the cooler, wet sites west of the Continental Divide. Common hardwood foliage diseases included septoria leaf spot and poplar leaf spot on cottonwood.

Fire blight was common on orchard and ornamental trees in the western and central parts of the State. Wet spring conditions were especially conducive to spread and buildup of this disease.

Weather-related disorders, especially those associated with extremely cold temperatures and spring frosts, were common in some areas. Several areas of winter damage were observed in lodgepole pine on the east end of the Big Snowy Mountains, just off the Red Hill Road near Lewistown. Several large areas were also observed west of Red Lodge.

However, overall damage was not as extensive as in previous years. The eruption of Mount St. Helens in 1980 caused blankets of volcanic ash to be deposited over major portions of western Montana. The effects of the ash on forest productivity and native disease incidence and severity are not known.

APPENDIX

List of Common and Scientific Names

List of Recent Publications

LIST OF COMMON AND SCIENTIFIC NAMES

INSECTS

Common Name	Scientific Name
coneworms	*Dioryctria* sp.
Douglas-fir beetle	*Dendroctonus pseudotsugae* Hopkins
fir engraver	*Scolytus ventralis* LeConte
larch casebearer	*Coleophora laricella* (Hubner)
mountain pine beetle	*Dendroctonus ponderosae* Hopkins
new budworm	*Argyrotaenia* sp. nr. *gogana* (Kearfott)
pine engraver	*Ips pini* (Say)
ponderosa pine needle miner	*Coleotechnites* sp.
spruce beetle	*Dendroctonus rufipennis* (Kirby)
western balsam bark beetle	*Dryocoetes confusus* Swaine
western spruce budworm	*Choristoneura occidentalis* Freeman

LIST OF COMMON AND SCEINTIFIC NAMES

DISEASES

Common Name	Scientific Name
annosus root rot	*Fomes annosus* (Fr.) Cke.
armillaria root rot	*Armillaria mellea* Vahl. ex Fr.
atropellis canker	*Atropellis piniphila* (Weir) Lohm. & Cash
black stain root disease	*Verticicladiella wageneri* Kend.
brown cubical butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Douglas-fir dwarf mistletoe	*Arceuthobium douglasii* Engelm.
Dutch elm disease	*Ceratocystis ulmi* (Buism.) C. Mor.
fir blueberry rust	*Pucciniastrum geoppertianum* (Kuehn) Kleb.
fir willow weed rust	*Pucciniastrum epilobii* Otth.
fire blight	*Erwinia amylovora* (Burr.) Winsl.
grand fir needle cast	*Lirula abietis-concoloris* (Mayr ex Dearn.) Dark.
laminated root rot	*Phellinus weirii* (Murr.) Gilb.
larch needle blight	*Hypodermella laricis* Tub.
lodgepole pine dwarf mistletoe	*Arceuthobium americanum* Nutt. ex Engelm.
lodgepole pine needle cast	*Lophodermella concolor* (Dearn.) Dark.
meria needle cast	*Meria laricis* Vuill.
poplar leaf spot	*Cercospora* sp.
septoria leaf spot	*Septoria musiva* Pk.
western larch dwarf mistletoe	*Arceuthobium laricis* (Englm.) Gill

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